

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/SE05/000272

International filing date: 25 February 2005 (25.02.2005)

Document type: Certified copy of priority document

Document details: Country/Office: SE
Number: 0400419-8
Filing date: 25 February 2004 (25.02.2004)

Date of receipt at the International Bureau: 08 March 2005 (08.03.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

PRV

PATENT- OCH REGISTRERINGSVERKET
Patentavdelningen

Intyg Certificate

Härmed intygas att bifogade kopior överensstämmer med de handlingar som ursprungligen ingivits till Patent- och registreringsverket i nedannämnda ansökan.

This is to certify that the annexed is a true copy of the documents as originally filed with the Patent- and Registration Office in connection with the following patent application.



(71) Sökande Appulia Ltd, Isle of Man GB
Applicant (s)

(21) Patentansökningsnummer 0400419-8
Patent application number

(86) Ingivningsdatum 2004-02-25
Date of filing

Stockholm, 2005-03-01

För Patent- och registreringsverket
For the Patent- and Registration Office


Gunilla Larsson

Avgift
Fee

A CABLE ENTRY DEVICE FOR EASY INSTALLATION

Technical Field

5 The present invention relates to a cable entry device for a conduit or cable, and more particularly a cable entry device for providing sealing in a space between a cable and a surrounding material.

10 Background of the Invention

When a cable or conduit is inserted through a hole of a material, there are a number of methods available for protecting the cable against damage and sealing one side of the material from the other. If the cable is inserted into
15 the interior atmosphere, of e.g. a cubicle, from the ambient atmosphere, a hole is made in the cubicle for inserting the cable.

A rubber cable entry or grommet may be tightly inserted into the hole of the cubicle, and a cable can be
20 inserted into the cable entry, causing sealing of the interior atmosphere of the cubicle from the surrounding atmosphere. However, this type of cable entry provides no locking of the cable to the cable entry. Also, it provides no locking of the cable entry to the surrounding material
25 and may relatively easy be pushed out of the hole. The rubber cable entry known in the art comprises flanges between which the material, in which the cable entry is inserted, is received. The flanges are extending outwardly from the hole on respective sides of the material to
30 provide sealing. However, when the cable entry is inserted into the hole, one of the flanges has to be pushed through the hole. The material of the flange has to be compressed to pass through the hole. Alternatively, a portion of the flange is pushed through the hole at the time, wherein the
35 material of the flange does not have to be compressed as much. However, assembling of such a cable entry is

cumbersome, especially for an assembler, who might fit hundreds of cable entries each day. Still another problem with the rubber cable entry is that it only fits material having a predetermined thickness. Different thickness
5 requires different cable entries.

Another cable entry known in the art solves the problems of locking it to the surrounding material, and locking of the cable to the cable entry. Such a cable entry is generally made of a solid material, comprising several
10 constituent parts, with a flexible sealing core. To connect the cable entry to e.g. a cubicle, a cylindrical main part of the fitting has to be provided with a sealing-ring before being entered into a hole of the cubicle. Furthermore, the main part is provided with threads, for
15 locking the main part to the cubicle by a threaded nut. Alternatively, the surrounding material itself is threaded. Inside the main part is a bushing provided for sealing the space surrounding the cable. Also, the main part is
20 provided with gripping tongues, which press the bushing towards the cable, causing both sealing and locking of the cable, when a cap is threaded onto the main part.

There is a problem with the cable entry providing locking in that it comprises several constituent parts, have a space-consuming design and is cumbersome to
25 assemble. Also, when the cable is inserted into the cable entry and the cap is threaded to press the tongues towards the cable, the cable may not be completely locked, since the cable can slip in either direction if pulled, and the tongues may damage the coating of the cable. Furthermore,
30 although the cable entry is manually adjustable to surrounding material of different thickness, assembling of the cable entry using the nut may be cumbersome, especially if it is assembled in a narrow space.

Summary of the Invention

It is an object of the present invention to provide a cable entry that is easy to push through a hole of a material. Another object of the present invention to provide a cable entry that is self-adjusting within a predetermined range to the thickness of the material.

A cable entry device according to the invention for providing sealing in a space between a cable and a surrounding material achieves the above objects. The device comprises a covering having first and second sealing members for receiving said material therebetween. The sealing members are formed by a recess in the covering. The covering comprises means for temporarily receiving the second sealing member during the insertion of the covering into the hole.

The means for temporarily receiving the second sealing member may comprise a recess of the covering having a depth corresponding to the thickness of the second sealing member. Furthermore, the means for temporarily receiving the sealing member may comprise an irregular surface of the covering having a first and a second portion. The second portion will extend at least partially through a hole of a surrounding material when inserted therein.

The first and second sealing members are flexibly connected to the covering, and the cable entry is automatically adjustable to materials having different thickness when inserted into a hole therein.

Further embodiments of the invention will appear from the dependent claims.

It is an advantage of the present invention that it is very easy to push through a hole into which the cable entry is inserted. Moreover, it is an advantage that the cable entry is automatically adjustable to different thickness of a surrounding material. Moreover, it is an

advantage of the present invention that it may comprise a core, wherein the cable entry may be locked to the surrounding material.

5 **Brief Description of the Drawings**

Further objects, features, and advantages of the invention will appear from the following description of several embodiments of the invention, wherein various aspects of the invention will be described in more detail with reference to the accompanying drawings, in which:

10 FIG 1 is a perspective view of a cable entry device;
 FIG 2 is a cross-sectional view of a cable entry with a cable inserted therein;
 FIG 3 is a perspective view of a first embodiment of
15 a core comprising means for strain relief;
 FIGS 4a and 4b are perspective views of a second embodiment of a core comprising means for locking the core;
 FIG 5 is a cross-sectional view of a covering;
 FIG 6 is a cross sectional view of another embodiment
20 of the covering;
 FIG 7 is a cross sectional view of another embodiment of the covering enclosing the core of FIGS 4a and 4b; and
 FIGS 8a and 8b are cross-sectional views of a cable entry comprising a core, a covering and detachable means
25 for strain relief.

Detailed Description of the Invention

When a cable 1 is inserted into e.g. a cubicle, there are international standards for tightness classification, such as the IP classification system, that specify to what
30 degree the internal atmosphere of e.g. a cubicle shall be sealed from the ambient atmosphere or fluid. Also, there are physical situations that require a cable 1 to be locked to a certain extent to the cubicle, to provide strain

relief. A cable entry or locking grommet is provided for insertion into a hole of a material.

FIG 1 illustrates a first embodiment of a cable entry device 100.

5 FIG 2 illustrates a first embodiment of the cable entry 100 in cross-section with the cable 1 inserted into it. The cable entry comprises a core 110 enclosed by a covering 200, preferably made of an elastomer, adaptable to a surrounding material for sealing a space between the
10 cable and the material. As should be noted, the cable entry may in different embodiment be provided with a core, wherein in other embodiments the cable entry do not have a core.

FIG 3 discloses a first embodiment of the core 110.
15 The core 110 comprises an intermediate portion 111 or support element extending axially, which may provide lateral support of the core 110. Locking means connected to an outer periphery of the the intermediate portion 111 for instantly connecting the core, and the covering surrounding
20 it, to the surrounding material when inserted into a hole therein. In this embodiment, the locking means comprises a flange 112 and detents 113a, 113b connected to the intermediate portion 111. When the core is inserted into a hole of a material, the diameter of the hole is less than
25 the diameter of the flange 112. Also, the distance between free ends of the detents 113a, 113b, are larger than the diameter of the hole. The diameter of the intermediate portion 111 is less than the diameter of the hole.

The core of FIG 3 is preferably made of a plastic
30 having a certain flexibility, such as a polyamide, e.g. PA 6, that is soften by a softener, which makes the plastic tough.

The detents 113a, 113b are connected to the intermediate portion 111 at one end thereof, and extend
35 from the intermediate portion towards the periphery of the

flange 112. Due to the material of the core 110 having a certain flexibility, the free ends of the detents 113a, 113b when pushed through a hole, are urged towards the intermediate portion 111. Thus, the distance between said free ends will be less than the diameter of the hole. Thus, by simply pushing the core through the hole of a material, the free ends of the detents 113a, 113b will be urged towards the intermediate portion. When fully through the hole, the free ends of the detents 113a, 113b, will return to their initial position. Thus, the core is locked to the surrounding material by means of the detents 113a, 113b and the flange 112, which forms a stop when the core 110 is pushed into the hole. The flange 112 prevents that the core 110 can be pushed through the hole in one direction, preferably from the interior to the exterior of the cubicle. The detents 113a, 113b prevents the core to be pushed back through the hole in the reverse direction.

According to one embodiment of the core 110, it may have means for providing strain relief. At the inside of the intermediate portion 112 are provided radially spaced flexible locking tongues 17 slightly directed in the direction of insertion of the cable 1. When the cable is inserted into the core 110 the tongues will abut the cable. Pulling the cable in the reverse direction will increase the pressure from the tongues towards the cable, wherein the strain relief is provided. The length of the tongues may vary, as will be explained below.

FIGS 4a and 4b disclose another embodiment of a core 150. The core 150 is preferably made of a rigid material, such as a plastic as described above. The core comprises a first and a second intermediate portion 151a, 151b, and locking means for locking the core 150 to a surrounding material when inserted into a hole thereof. The locking means comprises a flange 152 and a first and second detent 153a, 153b. The flange 152 corresponds to the flange

disclosed in FIG 3. The detents 153a, 153b are connected to legs or flexible portions 154a, 154b.

The flange 152 is connected to a first end of the intermediate portions 151a, 151b. The intermediate portions 151a, 151b extend substantially perpendicular from an inner periphery of the flange 152. The length of the flexible portions 154a, 154b correspond substantially to the length of the intermediate portions 151a, 151b. The detents 153a, 153b are connected to an upper portion of the flexible portions 154a, 154b, and extends therefrom towards the outer periphery of the flange 152. From a tip 155a, 155b of the detents a support surface 156a, 156b extends towards the flexible portions 154a, 154b. A support surface 157 of the flange 152 and the support surface 156a, 156b of the detents 153a, 152b are substantially parallel.

A base 158 of the flexible portions 154a, 154b, are connected to the intermediate portions 154a, 154b adjacent to the flange 152. Thus, although the inherent material characteristics of the core 150 are quite rigid, the width and thickness of the base 158, and the position thereof, provides flexibility of the flexible portions in the lateral direction of the core. In operation, as the support surface 157 of the flange 152 and the support surfaces 156a, 156b of the detents 153a, 153b are substantially perpendicular, the forces exerted on the flexibly portions 154a, 154b are substantially in the longitudinal direction of the flexible portions. Thus, the thickness of the base 158 may be dimensioned to comply with strain relief requirements.

When at least the intermediate portions 154a, 154b are enclosed by a covering, as disclosed below, the flexible portions 154a, 154b, are supported at an inner and outer side of the core 150 by said covering. Thus, the core, which is flexible, allows the flexible portions 154a, 154b to be urged towards the center of the core 150 when

pushed through the hole, allowing the detents 153a, 153b to pass through the hole. When fully through, the covering will return the flexible portions to their initial position, wherein the detents instantly connect the core 150 to the surrounding material. The core, and the covering, may easily be detached from the material surrounding it, wherein the cable entry may be reused. The core and the covering may be detached simply by pushing the detents 153a, 153b inwardly towards the center of the core, wherein it may be removed from the hole.

The thickness of the base 158 may be thinner than the remaining thickness of the flexible portions 154a, 154b. Thus, the flexibility may be further increased, whereas the material of the core 150 may be even more rigid. To obtain a good flexibility, the thickness of the base 158 is approximately 50% of the thickness of the flexible portions 154a, 154b. However, the relationship may be smaller or larger, or even substantially the same, depending on the requirement of flexibility and strength.

The flexible portions 154a, 154b, may be provided by forming slots in the intermediate portions 151a, 151b.

In the embodiments shown in FIGS 3, 4a and 4b, the intermediate portions 111, 151a, 151b are substantially cylindrically shaped and extending substantially perpendicular from the inside of the flange 112, 152 in the longitudinal direction of the core 100, 150. However, the intermediate portions 111, 151a, 151b may also be slightly conically shaped. The intermediate portions 111, 151a, 151b may alternatively have a polygonal cross section, as long as it fits into a hole of a material. Furthermore, the flange 112, 152 may be divided into sections forming several individual flanges circumferentially spaced around the intermediate portions 111, 151a, 151b. Also, any number of detents 113a, 113b, 153a, 153b, which provide sufficient locking of the core, is possible.

By altering the distance between the detents 113a, 113b, 153a, 153b and the diameter of the flange 112, 152, core 110, 150 may be adapted to holes of different diameter. Furthermore, by altering the distance between the
5 free end/tip of the detents 113a, 113b, 153a, 153b and the flange 112, 152, the core 110, 150 may be adapted to material of different thickness.

FIG 5 discloses the covering 200 for enclosing the core 110, 150. In the outer circumference of the covering
10 200 a recess 210 is provided for receiving the surrounding material when the cable entry is inserted into a hole. The recess 210 provides first and second flexible sealing members 220, 230 in the form of flanges on opposed sides of the recess 210, for sealing the space between the covering
15 and the surrounding material.

The covering 200 has first and second circular cuts 240, 241 provided on a first and second end portion of the covering 200, respectively. A cavity 242 is formed between the end portions. The end portions together with the cavity
20 242 form a passage, in which the cable 1 is to be inserted.

The first end of the covering surrounding the upper cut 240 forms a flexible collar 243, creating a tight seal between the covering 200 and the cable 1 when the cable 1 is inserted through the first cut 240.

At least one boss (not shown) may be provided on the
25 inside of the collar 243. An early release of vacuum in the cavity 242 is provided by the boss when the tool forming the cavity is pulled out of the first cut 240 during manufacturing. This allows for the manufacture of a very
30 thin membrane, forming a penetrable seal (not shown) of the second cut 241. The penetrable seal can be removed by simply penetrating the cable 1 through the seal rather than using a tool to create a circular hole. The penetrable seal makes it possible to seal a hole in the material
35 surrounding the covering 200 even if the cable 1 is not

inserted therein. The penetrable seal may alternatively be provided at the first cut 240. Thus, the boss may be provided at the inside of the second cut 241.

The cavity 242 comprises a circumferentially
5 extending slot 260 for receiving the flange 112, 152 of the core 110, 150. The inner surface of the cavity 242 will enclose the intermediate portions 111, 151a, 151b. The detents 113, 153a, 153b will extend out of cuts (not shown) of the covering when enclosed thereof.

10 When the core 110 is enclosed by the covering 200, a cylindrical lip 246 may enclose the tongues 114. The lip 246 is connected to the covering at the side of the second cut 241, extending therefrom towards the intermediate portion 111. When the cable 1 is inserted into the second
15 cut 241 the tongues 114 enclosed by the lip 246 are abutting, but not damaging, the cable 1. Alternatively, the lip 246 is partly slit open. Furthermore, the space between the cable 1 and the covering is sealed when the cable 1 is inserted therein.

20 The tongues 114 and the lip 246 provide a sealed locking of the cable 1 to the cable entry, which locking is instant when the cable 1 is inserted into the cable entry.

The covering 200 is provided with a cut (FIG 1) for receiving the detents 113a, 113b, 153a, 153b. Thus, the
25 detents 113a, 113b, 153a, 153b are not encapsulated by the covering 200 and can directly abut against the surrounding material.

The second end of the covering 200, to be pushed through a hole in the material has a diameter, which is
30 less than the diameter of the hole. Furthermore, the second sealing member 230 extends outwardly from the second end of the covering towards the free end of the first sealing member 220. At the free end of the second sealing member 230 the diameter is larger than the diameter of the hole.

35 When pushed through the hole, the second sealing member 230

will be urged towards the center of the covering 200,
wherein the cable entry is easy to insert into the hole of
the material, due to the recess 210 between the second
sealing member 230 and the center portion of the covering
5 200.

When the cable entry is inserted into the hole of the
material the flexible first sealing member 220 of the
covering 200 is extending outwardly from an edge of a first
side of the material surrounding the hole. When the free
10 end of the first sealing member 220 meets the material it
is compressed and slides outwardly from the hole as the
cable entry is further pressed through the hole. When the
second sealing member 230 is fully through the hole, the
second sealing member provides a biasing force on the
15 covering urging the first sealing member towards a second
side of the material surrounding the covering 200. Thus,
the space between the covering 200 and the surrounding
material is sealed, as the free ends of the sealing members
220, 230 abut the material received therebetween.
20 Consequently, the space between the covering 200 and the
surrounding material is sealed. If the covering 200
encloses a core, the covering 200 is locked to the hole of
the material by means of the locking means, and a seal to
both sides of the surrounding material is provided.

25 In another embodiment, locking means is provided as
an integral part of the covering as solid rubber or
elastomer detents. However, the arrangement of these
detents are substantially the same as the detents as set
forth above, albeit formed as integral with the covering.
30 Thus, the elastomer detents are extending outwardly towards
the first sealing member 220 of the covering 200 for
providing locking of the covering according to the same
principles as set out above. If the covering comprises a
core, the intermediate portion is provided with cut-in

portions for receiving each of the elastomer detents when the cable entry is inserted into a hole.

FIG 6 discloses a covering 400 according to the invention. A recess 410 is provided in the outer circumference of the covering 400 for forming first and second sealing members 420, 430, such as flexible flanges. The covering 400 comprises means for temporarily receiving a second sealing member 430 insertion of the covering into the hole. One side of the recess 410, which is outwardly facing the sealing members 420, 430 and inwardly facing the intermediate portion of the core, when receiver therein, or the cavity, has an irregular surface 440. A first portion 441 of the irregular surface 440 has a diameter, which is larger than the diameter of a second portion 442 of the irregular surface 440. The second 442 portion may be formed as a recess of the covering 400 or the first portion 441. The first portion 441 faces outwardly an inner side of the first sealing member 420. The second portion 442 faces outwardly an inner surface of the second sealing member 430. The difference in diameter between the first and second portions 441, 442 corresponds substantially to twice the thickness of the second sealing member 430 of the covering 400. Thus, when the covering 400 is pressed through a hole, the second sealing member 430 is received within the second portion of the irregular surface 440, wherein it is even easier to press the covering through the hole as the covering 400 does not have to be compressed at all. The diameter of the first portion 441 of the irregular surface 440 is less than the diameter of the hole. The diameter of the first portion 441 is preferably only slightly less than the diameter of the hole, wherein the covering 400 is fitted to the surrounding material. Correspondingly, the diameter of the second portion 442 of the irregular surface 440 plus twice the thickness of the

second sealing member 430 of the covering 400 is slightly less than the diameter of the hole.

The length of the first portion 441 of the irregular surface 440, and the total length of the irregular surface 440 is dimensioned such that said first portion will extend at least partially through the hole when the covering is inserted therein. Thus, when the sealing members 420, 430 extend outwardly from the hole, the covering will be laterally supported by the first portion 441.

The recess 410 and the sealing members 420, 430 according to the embodiment shown in FIG 6 provide instant adjustment of the covering to different thickness of the surrounding material when the covering is pressed through a hole thereof. The first sealing member 420 extends outwardly from the upper end of the covering. The second sealing member 430 extends outwardly from the second end of the covering 400. The thickness of the sealing members 420, 430 is such that they are flexible at least 90 degrees relative the irregular surface 440. When the covering 400 is inserted into a hole, the free ends of the sealing members 420, 430 will automatically slide outwardly from the hole. The distance between the connection points of the sealing members 420, 430 determines the range of material thickness, to which a specific covering is suitable.

If the covering 400 comprises a core 110, 150, the distance between the support surfaces 155a, 155b of the detents 113a, 113b, 152a, 153b and the size of the recess 410 determines the range of material thickness, to which a specific covering is suitable.

FIG 7 discloses a cable entry 500 comprising a covering 510 and a core 150. Parts of the covering 510 not explicitly described with regard to FIG 7 correspond to the parts described with regard to FIG 6. The covering 510 comprises strain relief means integral with the covering.

On an inner side of a first end 520 of the covering 510

facing a cavity 530 of the covering 510 is provided hooks 540 for abutting the cable when inserted into the cavity. When the cable is inserted, the hooks being flexible are urged towards the periphery of the covering 510. When the
5 cable is pulled in the reverse direction, a friction between the cable and the hooks 540 will provide strain relief. The harder the cable is pulled in the reverse direction, the greater is the friction up to a certain amount. The amount of the friction is dependent of the
10 number and material of the hooks 540, and the material of the covering of the cable.

A conically shaped second end 550 opposing the first end 520 of the covering 500 may have means for providing strain relief. At the top end of the conically shaped
15 portion is an inwardly facing circular surface 560 provided. The circular surface extends substantially in the longitudinal direction of the covering 510, i.e. in the direction of insertion of the cable. When a cable is inserted through the covering 510, the circular surface
20 will abut the cable, wherein a friction is created therebetween. When the cable is pulled in the reverse direction the friction will cause the conically shaped portion 550 to be compressed. Thus, a certain strain relief will be provided, the amount of which depending on the size
25 and type of material of the circular surface 560, and the material of the cable. To further increase the strain relief, protrusions 570 may be provided at the outer periphery of the top end of the conical portion 550. When
30 the cable is pulled backwards, the protrusions 550 will cause the circular surface 560 to remain parallel with the cable, wherein the friction is maintained. As long as the conically shaped end 550 does not collapse, i.e. extend in the reverse direction of insertion of the cable 1, strain relief will be provided.

If the covering 500 of FIG 7 comprises a core 150, the conical end 560 when compressed will be urged towards the flange 152 of the core 150. Thus, the covering is more rigid when enclosing a core, wherein it is heavier to
5 compress the conical portion 550. Thus, the strain relief may be even further improved.

FIGS 8a and 8b disclose a cable entry 600 having a core 610 and a covering 620. A detachable strain relief means 630 may be attached at one end of the cable entry 600
10 to the core 610. The strain relief means comprises tongues 640 as disclosed above. The length of the tongues is alternating shorter and longer. Thus, the strain relief means fit cables of different size. The strain relief means may comprise two equal halves snap fitted to the core 610.
15 The strain relief means may be detached when the cable is inserted into the cable entry 600, wherein the cable may be removed from the cable entry.

A cable entry device according to the invention may not comprise the core. Thus, the covering as disclosed
20 above may be used without the core, wherein several advantages may still be provided, such as the irregular surface for easy push through and/or the self-adjustment to different thickness.

The core and covering is disclosed as circular.
25 However, they may equally be quadrilateral depending on the form of the hole into which they should fit.

The covering is made of a flexible material, such as an elastomer, e.g. TPE (thermoplastic elastomer), EPDM (Polyethylene-Propylene-Diene-Monomer), or chloroprene.
30

The present invention has been described as applicable to a cubicle by way of example. However, the invention is not limited to this single application, it is also applicable to holes of many other applications, such as electrical control cubicles, instrument housings,
35 household appliances, cable entries in walls, conduit

- entries etc. Also, for simplicity reference has been made to a cable, which is not intended to limit the scope of the invention. As is understood, the invention may equally be used with e.g. a conduit for conducting fluids, or a wire.
- 5 The scope of the invention is best defined of the appended independent claim.

Claims

1. A covering (400, 510, 620) for a cable entry device (500, 600) for providing sealing in a space between
5 a cable (1) and a surrounding material, comprising first and second sealing members (420, 430) for receiving said material therebetween formed by a recess (410) in outer
periphery of the covering, **characterized** in that the covering comprises means (440, 441, 442) for temporarily
10 receiving the second sealing member during insertion into a hole of said material.

2. The covering according to claim 1, **characterized** in that the means for temporarily receiving the second
15 sealing member comprises a recess of the covering having a depth corresponding to the thickness of the second sealing member (430).

3. The covering according to claim 1 or 2,
20 **characterized** in that the means for temporarily receiving the sealing member comprises an irregular surface (440) of the covering having a first and a second portion (441, 442), the first portion having a diameter corresponding to the diameter of the hole, to which the device is
25 dimensioned for, and the diameter of the second portion plus twice the thickness of the second sealing member (430) correspond to the diameter of said hole.

4. The covering according to claim 3, **characterized**
30 in that the second portion (441) will extend at least partially through the hole when inserted therein.

5. The covering according to any of the claims 1 to 4, **characterized** in that the first and second sealing
35 members (420, 430) are flexibly connected to the covering.

6. The covering according to any of the previous claims, **characterized** in that the diameter at a free end of the first sealing member (420) is smaller than the diameter of a free end of the second sealing member (430).

7. The covering according to any of the previous claim, **characterized** in that the first sealing member (420) extends outwardly from a first end of the covering towards the second sealing member, and the second sealing member (430) extends outwardly from a second end of the covering towards the first sealing member.

8. The covering according to any of the previous claims, **characterized** in that the first sealing member provides a biasing force on the covering when inserted into a hole of the material.

9. The covering according to claim 8, **characterized** in that the first and second sealing members (220, 230, 420, 430) are flexibly connected to the covering.

10. The covering according to claim 8 or 9, **characterized** in that the circumference at a free end of the first sealing member (220, 420) is larger than the circumference of a free end of the second sealing member (230, 430).

11. The covering according to any of the claims 8 to 10, **characterized** in that free ends of the first and second sealing members (220, 230, 420, 430) abut a first and a second side of a material, respectively, when inserted into a hole therein.

12. The covering according to any of the claims 8 to
11, **characterized** in that the first sealing member (220,
420) extends outwardly from a first end of the covering
towards the second sealing member (230, 430), and the
5 second sealing member extends outwardly from a second end
of the covering towards the first sealing member.

13. Use of the covering according to any of the
claims 1 to 12 as a cable entry device.

10

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186

Abstract

A cable entry device (500, 600) for providing sealing in a space between a cable (1) and a surrounding material.

5 The device comprises a covering (400, 510, 620) having sealing members (420, 430) for receiving said material therebetween. The sealing members are formed by a recess (410) in the covering. The covering comprises a recess for temporarily receiving the second sealing member when it is

10 inserted into a hole.

To be published together with FIG 6.

2001-08-24

1/9

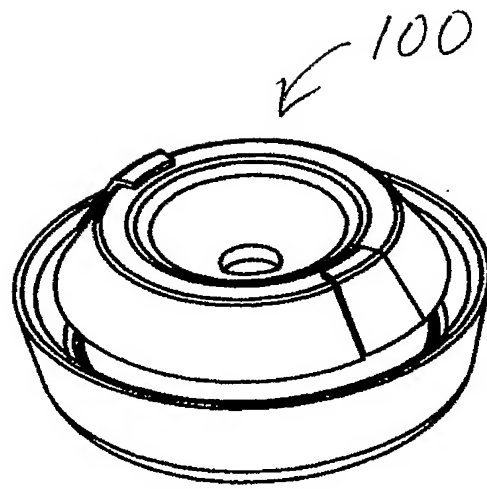


FIG 1

2/9

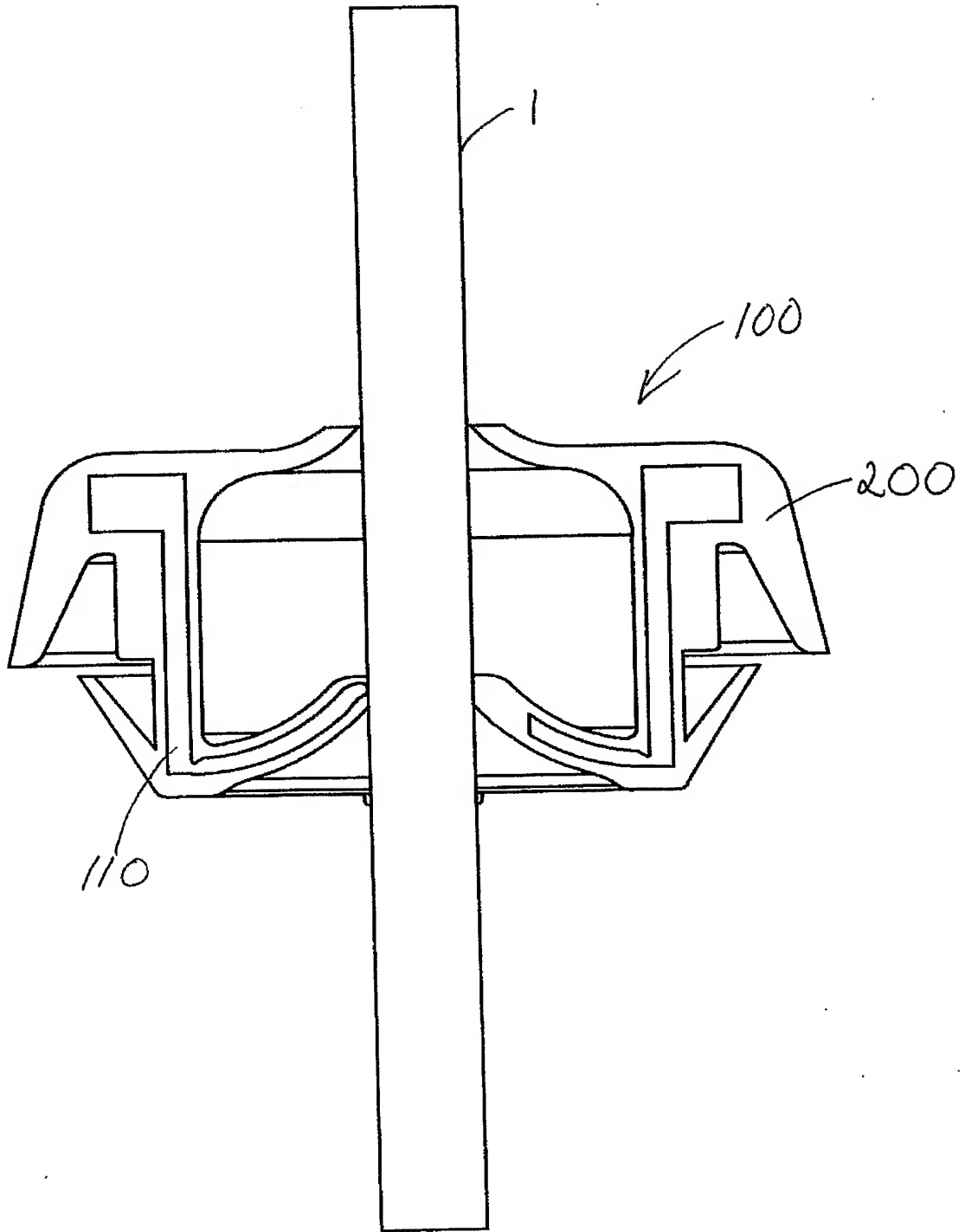
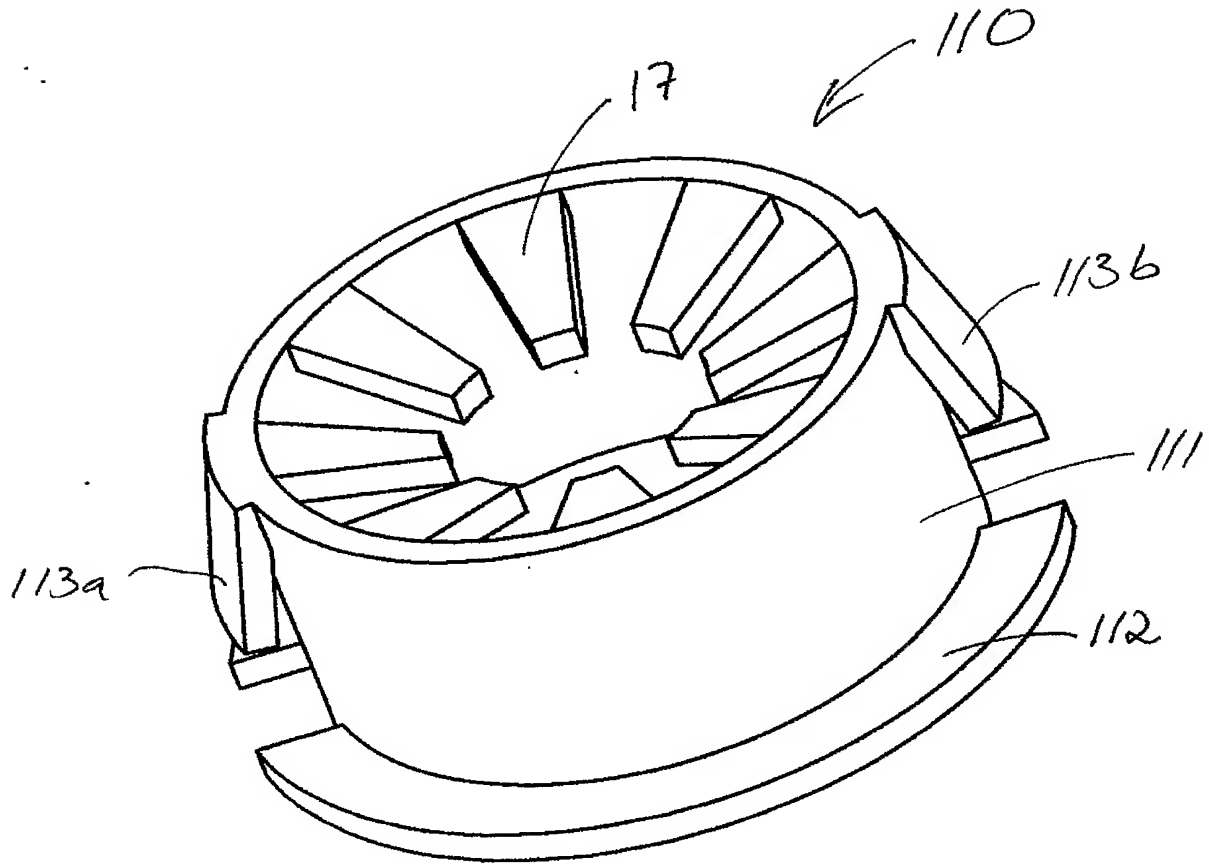


FIG 2

04004199

3/9



F163

01004-12 2021

4/9

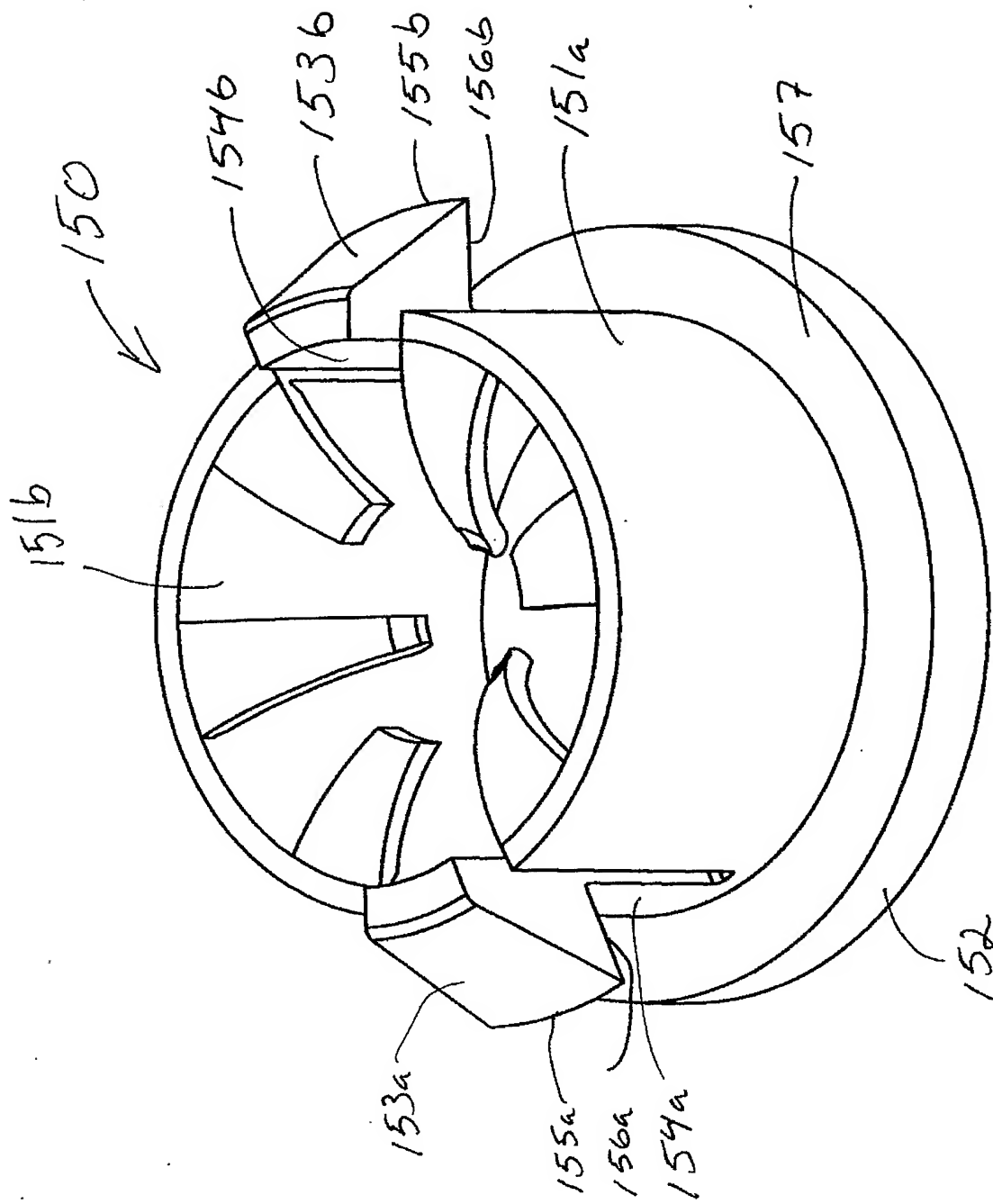


FIG. 4a

0400613-8

5/9

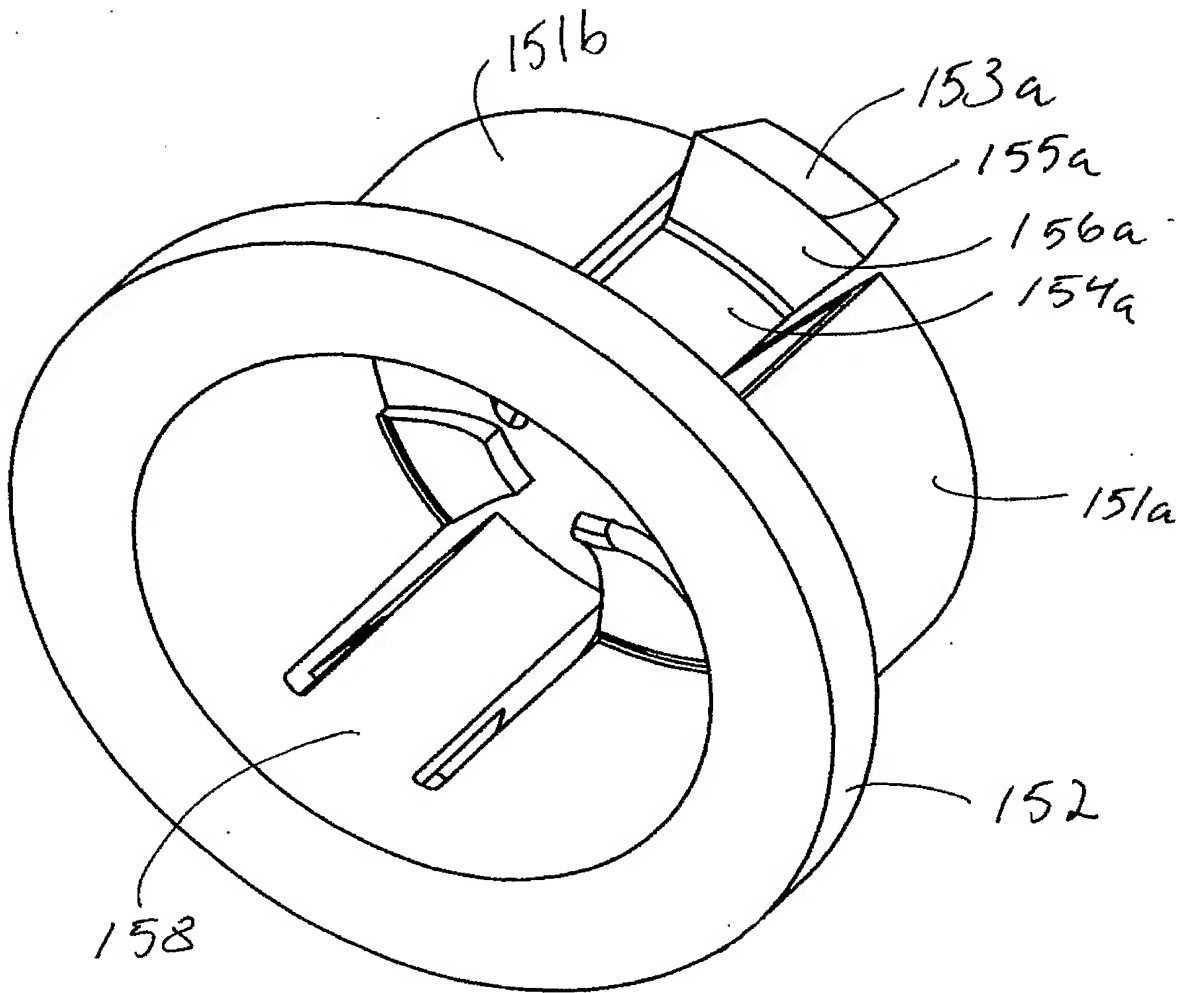


FIG 46

6/9

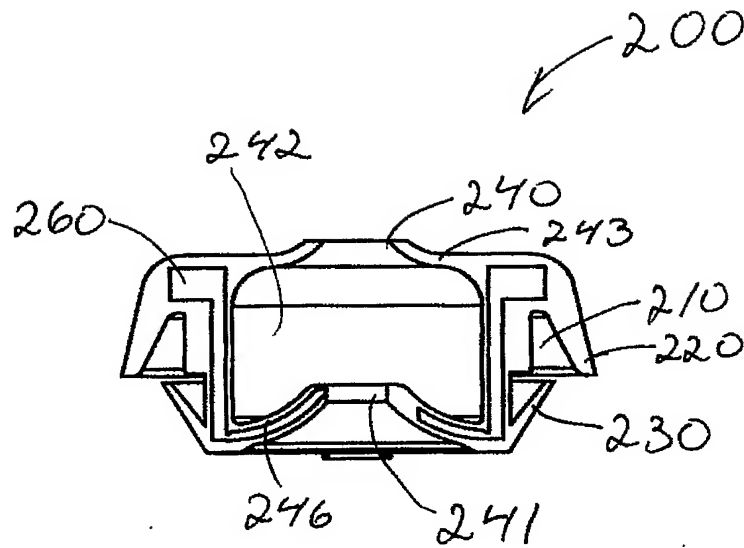


FIG 5

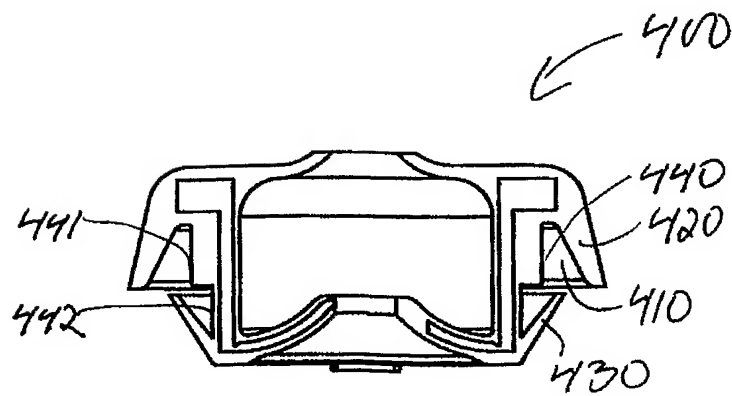
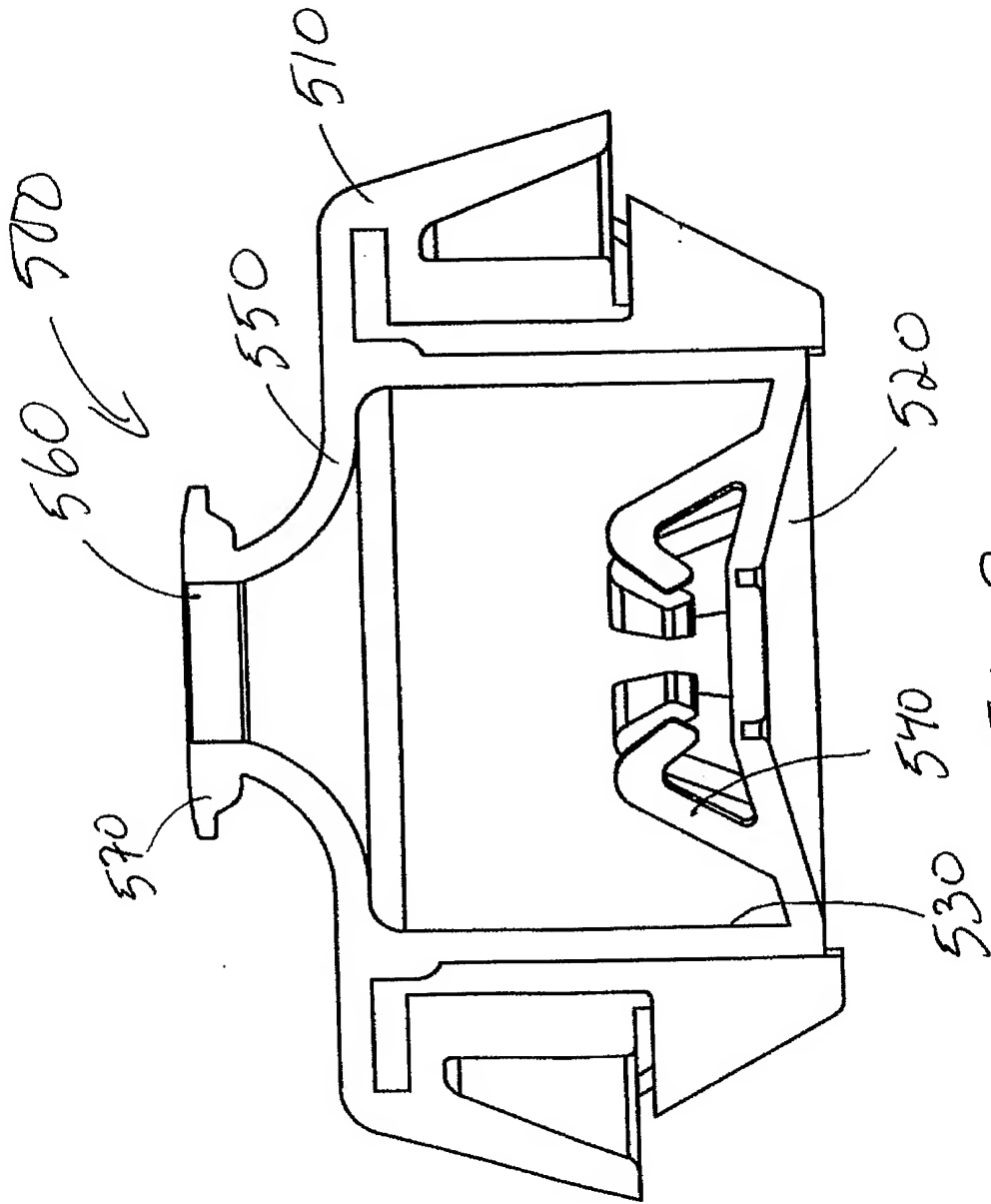


FIG 6

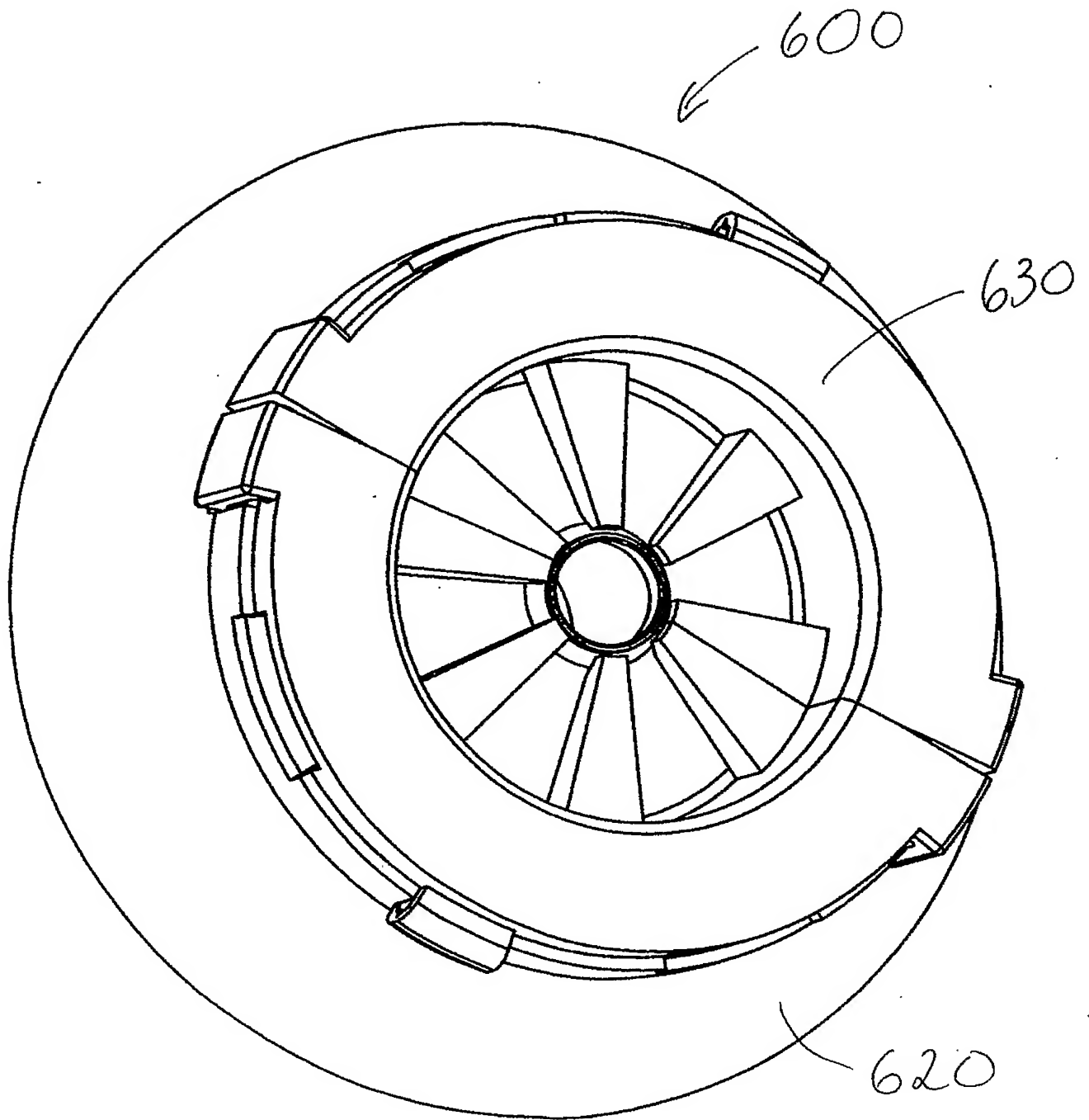
0100411818

7/9



F1677

8/9

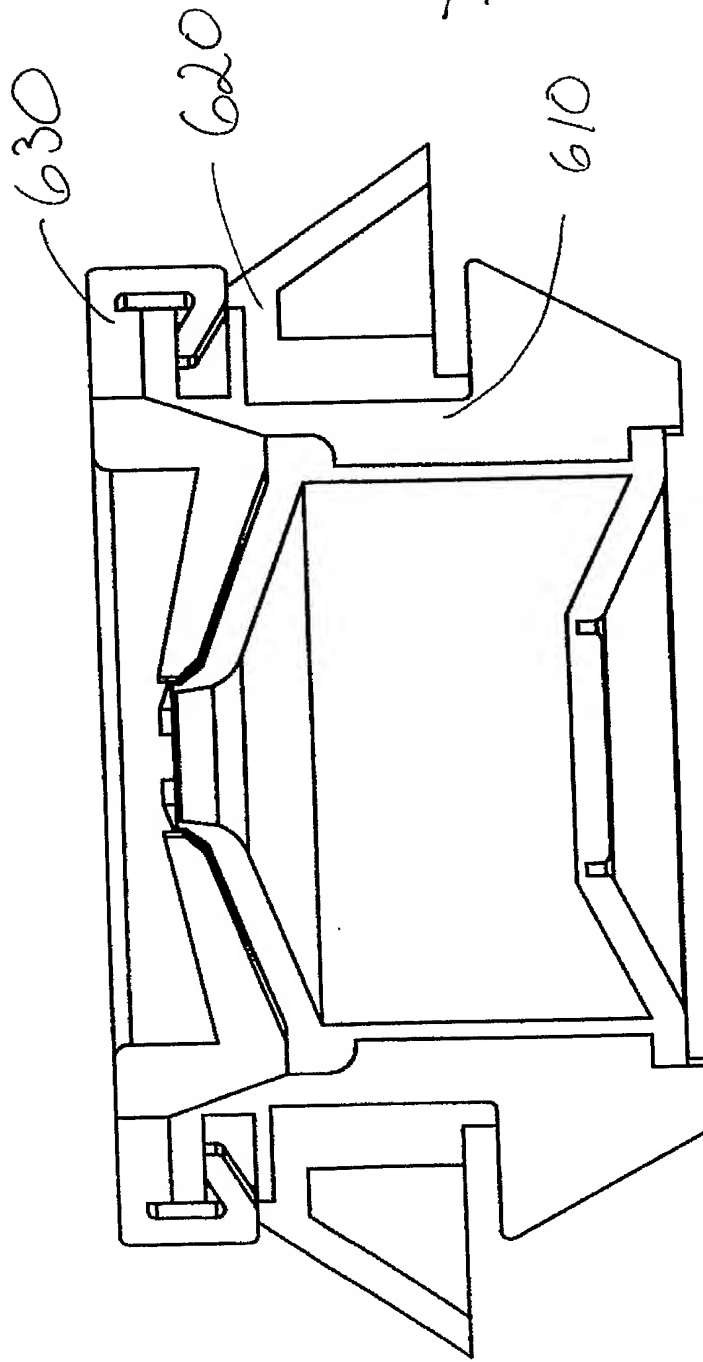


F167 8a

04.004.19-9

2004.05

9/9



F1686

0400419-9